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WATER CURRENT

UNL Water Center — Part of the School of Natural Resources

Vol. 36, No. 1 Winter 2004

UNL Water Law, Policy and Science Conference is Mar. 4-5

By Steve Ress

The University of Nebraska's First Annual Water Law, Policy and Science Conference is Mar. 4-5 at UNL's College of Law, Lincoln.

Pre-registration at a reduced rate will be accepted through Feb. 23. Registration and other conference information is available at snr.unl.edu/waterconference22004.

Finding solutions to multi-jurisdictional water conflicts is the focus of the two-day event that features several nationally prominent speakers and is the inaugural event for UNL's interdisciplinary Water Resources Research Initiative (WRRI).

"From endangered species to ground and surface water use and management, Nebraska is at the cross-

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Summer Tour Is June 7-9

The Kearney Area Chamber of Commerce and Nebraska Water Conference Council's 2004 summer water and natural resources tour is June 7-9, focusing on threatened and endangered species issues in the Lower Platte River basin.

This is about six weeks earlier than typical tour dates, with this year's dates being chosen to help beat the heat.

"We'll spend some time exploring the river itself and so we thought this might be a better time to beat the summer heat and humidity," said tour co-organizer Mike Jess, associate director of the UNL Water Center.

Initial planning is for the tour to begin in Kearney, with a first night stay in the Columbus area and second night stay in Omaha before returning to Kearney mid-afternoon of the third day. One of two anticipated tour buses will start and finish the tour from Lincoln. More details, as well as registration information, will be mailed to past tour participants in the coming months.

The tour is co-sponsored by Nebraska Public Power District, Central Nebraska Public Power and Irrigation District, Nebraska Association of Resource Districts and UNL's Institute of Agriculture and Natural Resources, School of Natural Resources and Water Center.

Sheri Fritz of Geosciences, UNL Chancellor Harvey Perlman and Water Center director Kyle Hoagland review events for a daylong water faculty retreat outlining the Water Resources Research Initiative that Fritz and Hoagland co-chair. The retreat was hel at UNL's Agricultural Research and Development Center near Mead on Jan. 15. More than 50 NU research faculty and administrators attended (photo: Steve Ress).

Inside

Water Resources Research Initiative Off To Fast Start in 2004

from the DIRECTOR

Kyle D. Hoagland

2004 is off to a fast and exciting start in the water arena at the University of Nebraska! The campus-wide Water Resources Research Initiative (WRRI) took a major stride toward its goal of helping UNL become a world leader in water research, education, and outreach. The WRRI's recent Program of Excellence proposal was successful, which will help bring six new water faculty to UNL in the fields of surface hydrology, climate modeling, aquatic chemistry, stream/river ecology, human dimensions of water (e.g., economics), and water law/policy. We are delighted that Dr. Sandra Zellmer recently accepted the water law/policy position in the UNL College of Law. Dr. Zellmer initially came to us last year as a visiting associate professor of law from her faculty position at the University of Toledo College of Law. Everyone she has worked with this past year is extremely pleased she has accepted the offer to stay at UNL permanently. She broadens the scope of our collective water expertise immensely and is a key player in bringing important elements of the WRRI to fruition.

WRRI co-leader Dr. Sherilyn Fritz's and my aim is to add water faculty expertise in other critical areas, as well as create bridges among as many of our existing faculty as possible, thus many of these positions will likely involve joint appointments between more than one UNL department.

In addition, this award will bring several pieces of major equipment to the UNL Water Sciences Laboratory, helping maintain its reputation as a world-class facility in analyzing trace contaminants. These additions include a state-of-the-art ICP-MS for heavy metal analysis (i.e. Pb and As, not Megadeath) and other equipment, eliminating the need for UNL water researchers and other local clients of the lab to out-source their water analyses requirements.

This award also provides resources for an annual, high profile water law, policy and science conference, the first of which will be held March 4-5 at the UNL College of Law (see article in this issue). This first conference, entitled "Finding Solutions to Multi-jurisdictional Water Conflicts" is being organized by Dr. Zellmer, and brings a large number of nationally recognized water law and policy speakers to Lincoln, many for the first time. The theme of this water conference will change each year.

Finally, these funds will allow us to offer an expanded water resource seminar series each spring, which as always, will be free to the public.

Also, as part of efforts to inform faculty of new opportunities the WRRI presents and to generate enthusiasm for this new water initiative, we hosted a daylong research retreat at UNL's Agricultural Research and Development Center near Mead, on Jan. 15. The retreat focused on forming larger, interdisciplinary research teams focused on successfully competing for larger extramural federal funding opportunities. More than 50 research faculty members and administrators, including, UNL Chancellor Harvey Perlman, took part in the day's activities, and as one participant said, it was more of a charge than a retreat! So, we hope to make significant progress this year toward achieving the water initiative's overall goals.

On a final note, rest assured that planning for the annual summer water and natural resources tour is progressing. As noted elsewhere in this issue, jump-off for the tour has been moved up this year. Instead of the traditional dates in the third week of July, the tour will be held June 5-7 in order to take advantage of cooler weather in the Lower Platte River basin at that time of year. We will keep you informed as planning for this event unfolds.

I hope that your New Year is a healthy and happy one!

WATER CURRENT

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Meet the Faculty

C. William Zanner, Ph.D.

Assistant Professor of soil geomorphology, University of Nebraska-Lincoln School of Natural Resources and Conservation and Survey Division. Adjunct Assistant Professor, Department of Soil Sciences, North Carolina State University.

William Zanner

Education:

Ph.D., Soil Science, University of Minnesota, 1999.
M.S., Soil Science, University of Minnesota, 1992.
B.A., University of Wisconsin–Madison, 1971 (with honors).

Current Research/Extension Programs:

— Effect of forest establishment on microbiological, mineralogical, physical, and chemical properties of prairie soils at the Halsey National Forest with grad student, UCARE undergrad and colleagues in Agronomy and Horticulture.

— Soil carbon studies in the Nebraska Sandhills and in eastern Nebraska pastureland with faculty and grad students in Agronomy and Horticulture.

— ***Soils and stratigraphy of Nebraska:*** Nebraska State Soil Survey; stratigraphic research to support work of the Nebraska Grout Task Force Project; clay mineralogy of Scott's Bluff bedrock; landscape evolution of the Nebraska Rainwater Basins.

— ***Wetlands research:*** The potential for stream channel improvement and riparian area restoration from the reintroduction of beavers with faculty from SNR and Biosystems Engineering. Little Salt Creek Saline Wetlands with Ed Harvey. Restoration of a Carolina Bay Wetland, Robeson County NC with colleagues and grad students from North Carolina State University.

— ***Paleoclimate research:*** Reconstructing past climates of the Great Plains, and the implications for future climate with colleagues from Trinity College (Hartford CT) and Kansas.

— Interdisciplinary research: Part of the NSF-funded Sand Hills Biocomplexity Project

(continued on page 7)

George E. Meyer, Ph.D.

Professor, University of Nebraska-Lincoln Department of Biological Systems Engineering, specializing in plant growth modeling and instrumentation. Past chair of Biological Systems Engineering.

Education:

Ph.D., Food and Agricultural Engineering, University of Massachusetts, 1972
M.S., Food and Agricultural Engineering, University of Massachusetts, 1971
B.S., Agricultural Engineering, Cornell University, 1967

Current Programming:

Research includes machine vision, electronic optical sensor design, thermal and spectral analysis for plant/weed detection, identification, enumeration, physiological properties and stress applied to both field and greenhouse site specific crop management. Mathematical modeling and simulation of plant growth and development. Use of soft computing, fuzzy logic set theory, and artificial neural-network systems for mathematical modeling and classification of plant, residue and soil related imaging and remote sensing.

Past Programming:

$1.4 million in research grants, including USDA, NSF, USGS and industry. $199,000 in teaching grants.

Other Extension/Outreach Programs:

— Continuing developmental professional workshop: *Why Thermodynamics of Living Systems is Important to Your Curriculum* (International ASAE meetings, Sacramento, CA, 2001).

— Continuing developmental professional workshops: *Fuzzy Logic for Engineering Applications*, (International ASAE meetings, Sacramento, CA and Chicago, IL, 2001).

— Continuing developmental professional workshops: Distance Education Practicum (International ASAE meetings Toronto, Canada and Milwaukee, WI, 1999 and 2000).

— Taught distance education courses (AG*SAT and ADEC,) 1990-1996.

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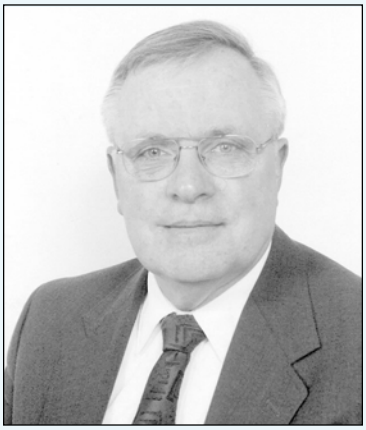

George Meyer

Bringing a Community Lake Back to Life

Neligh Park Lake is located in West Point and was formed from a tributary to the Elkhorn River. It lies in Neligh Park, the site of city baseball fields, camping and picnic areas and the Cuming County fairgrounds. In earlier days, the 3.5-acre lake was used by West Point residents for fishing, ice-skating, and swimming.

Problems

The lake had a maximum depth of four feet. As a result, fish populations were virtually non-existent. In addition to being shallow, it was high in nutrients, lacking aquatic vegetation, and very turbid. Sediment accumulation in the lake were the result of stormwater drainage from the park and developing urban areas. Overflow from the Elkhorn River would also backflow through outlet pipes constructed in the flood control levee, inundating the park with water, sediment, and debris.

Solutions

Over the past 10 years, West Point has implemented measures to address water quality impacts to the lake. These included installation of flap gates on the flood-water overflow pipes and stormwater drainage projects to reduce the watershed area. West Point initiated a lake restoration project on the lake in 2002. The primary component of the project was removing 50,000 cubic yards of sediment, which would increase maximum depths from 4 feet to over 12 feet. Other components of the project included replacing inlet and outlet structures, shoreline stabilization, vegetation barriers, and handicap access.

Project partners included the City of West Point, Nebraska Environmental Trust, U.S. Environmental Protection Agency, Nebraska Department of Environmental Quality, Nebraska Game and Parks Commission, University of Nebraska-Lincoln, and Gilmore and Associates. The one-year project was completed at a cost of $393,036.

Results

In addition to enhancing aesthetic qualities of the lake, the project resulted in significant water quality improvements (Table 1). The largest improvement was in water clarity, which increased by 327%. Reductions in lake nutrient concentrations were also achieved. Total phosphorus decreased by 87% and total nitrogen decreased by 82%. Reductions in nutrient concentrations lead to a 78% decrease in algae. The increase in water clarity will allow for establishment of aquatic vegetation, which will provide habitat, uptake nutrients, and help stabilize shorelines. The lake has been restocked with largemouth bass, bluegill, and channel catfish.

Table 1. Water Quality Improvements Measured in Neligh Park Lake.

Parameter	*Pre-project (2001)*	*Post Project (2003)*	*% Change*
Lake Turbidity (NTU)	133	7	-95
Total Phosphorus (_g/l)	659	84	-87
Total Nitrogen (_g/l)	6084	1100	-82
Chlorophyll *a* (mg/m^3)	250	55	-78
Water Transparency (inches)	6	25	+327

For More Information Contact:

General Project Information
Tom Goulette
City of West Point
(402) 372-2466

Educational Components
Tadd Barrow
University of Nebraska-Lincoln
(402) 472-7783

Project Engineering and Design
John Zwingman
Gilmore and Associates
(402) 564-2807

Fisheries
Rick Eades
Nebraska Game and Parks Commission
(402) 471-5445

Water Quality
Paul Brakhage
NE Dept. of Environmental Quality
(402) 471-4224

UNL Water and Natural Resources Lectures

Current water and natural resources issues are the focus of a series of free public lectures on the University of Nebraska-Lincoln's East Campus that began in January and run through April.

The lectures are 3-4 p.m. each Wednesday through April 28, except March 17, at L.W. Chase Hall on UNL's East Campus.

More than half the speakers are from the School of Natural Resources, which was created in July 2003 by combining the Conservation and Survey Division, Water Center and former School of Natural Resource Sciences.

UNL scientists are covering topics ranging from emergency response and homeland security planning using geographic information systems technology to geology of the Lewis and Clark expedition and from the future of the University of Nebraska State Museum to studies of bats.

Some lectures will feature outside speakers including: Steve Schwartz, Oklahoma State University discussing wetland biodiversity, Casey Kruse of the U.S. Army Corps of Engineers talking about the biological needs of interior least terns and piping plovers in the Missouri River valley, and Randy Kolka of the U.S. Department of Agriculture Forest Service in Grand Rapids, Minn., discussing better understanding of ecosystems through multidisciplinary science.

Remaining lectures in the series:

Feb. 4: Brigitte Tenhumberg, SNR, "Mathematical Modelling in Conservation Biology: Sustainable Wildlife Harvesting and Captive Breeding."

Feb. 11: Derek Ryter, Doane College, Crete, "Late Quaternary Climate Change Signals in a Tectonically Active Area — the San Jacinto Fault Zone, Southern California."

Feb. 18: Casey Kruse, U.S. Army Corps of Engineers, Omaha, " The Biological Needs of Interior Least Terns and Piping Plovers in the Missouri River Valley."

Feb. 25: Geological and Natural Resources Observations Across the Great Plains."

March 3: Gary Willson, National Park Service, Cooperative Ecosystem Studies Unit (CESU), SNR, "Research and Technical Assistance to National Parks through the Great Plains CESU."

March 10: Priscilla Grew, NU State Museum, "The Future of the University of Nebraska State Museum."

March 17: No seminar - UNL spring break.

March 24: Steve Schwartz, Oklahoma State University, Stillwater, Okla., "Biodiversity in Ephemeral Wetlands Across Landscape Scales."

March 31: Kremer Lecture: Michael Meyer, U.S. Geological Survey, "Endocrine Disruptors and Emerging Contaminants: New Paradigms? Examples of Occurrence in Surface Water."

April 7: Williams Lecture: Jack Jones, University of Missouri, Columbia, Mo., "The Role of Land Cover on Reservoir Trophic State in Missouri."

April 14: Randy Kolka, USDA Forest Service, "Understanding Ecosystems through Multidisciplinary Science."

April 21: Hannan LaGarry, SNR, "The Nebraska Geological Survey's Recent Advances in the Tertiary Stratigraphy of the Northern Great Plains."

April 28: Bill Capehart, South Dakota School of Mines and Technology, Rapid City, S.D., "Role of Prairie Wetlands in Regional Weather and Climate."

Anatoly Gitelson and John Holz, both research faculty members in UNL's School of Natural Resources, review a presentation on research collaboration and funding possibilities at a retreat for water faculty members on the Water Resources Research Initiative held Jan. 15 at UNL's Agricultural Research and Development Center near Mead. Moe than 50 NU research faculty and adminstrators attended the daylong event (photo: Steve Ress).

Fact Sheets Explore Water Transfer and Marketing, Management of Dakota Aquifer

Water transfer and marketing in Nebraska are featured in a free fact sheet published by the University of Nebraska-Lincoln's Conservation and Survey Division (CSD). Groundwater chemistry and management of the Dakota aquifer, the state's most important secondary aquifer, are examined in a second CSD fact sheet.

Water Transfer and Marketing in Nebraska by UNL water specialist J. Michael Jess, addresses the current state of Nebraska laws regulating transfer of surface water or groundwater.

"Surface-water appropriations and transfer are governed by laws that are straightforward but numerous," the associate director of the UNL Water Center said.

"Regulations on transfers of groundwater have been left largely to the courts and often are governed by the common law prohibition on transfer from overlying land. However, various exceptions have been set forth by the courts and specific legislation," he notes.

In *Geology, Groundwater Chemistry and Management of the Dakota Aquifer in Nebraska*, UNL groundwater geologists David Gosselin and F. Edwin Harvey, and editor Charles Flowerday, all with CSD and the School of Natural Resources, use groundwater chemistry to assess the history of the water in the Dakota aquifer and explore management issues related to it.

The Dakota is a key secondary aquifer, particularly in the eastern Nebraska, but its water is often mineralized. It may also lie under confining layers of shale, clay or silt, which may restrict recharge and require special management strategies, Gosselin and colleagues said.

The fact sheet series, called *Earth Science Notes*, provides four to six pages of information on diverse research topics involving Nebraska's natural resources. Copies of *Earth Science Notes* are available from Conservation and Survey Division, 113 Nebraska Hall, University of Nebraska-Lincoln, Lincoln, NE., 68588-0517; e-mail: csdsales@unl.edu or phone (402) 472-7523. Single copies are free; multiple copies are $2 each. If requesting multiple copies be sent by mail, add a $2 fee. Nebraska residents should add city and state sales tax.

Water Levels Continue Decline in High Plains Aquifer

By Steve Ress

Overall water level declines continue in the High Plains Aquifer over most of the eight-state aquifer area, according to a recent report from the U.S. Geological Survey.

Cumulative loss of water from 1987 to 2002 is about 56 million acre-feet or about 29 percent of the total loss since development of the aquifer for irrigation became widespread over the last 60 years. An acre-foot of water equals more than 325,850 gallons

The High Plains aquifer underlies parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas and Wyoming. Cropland acres irrigated from it have increased from 2.1 million acres in 1949 to 13.9 million acres by 1997.

From 2000 to 2001, the average decline in the aquifer was 0.62 feet, based on measurements from 7,650 wells, according to the USGS. An overall decline of 0.23 feet was noted the previous year, based on sampling a similar number of wells.

The 2000 to 2001 report notes, "Water-level declines occurred over most of the aquifer area except in part of Texas, primarily north of the Canadian River where water-level rises occurred."

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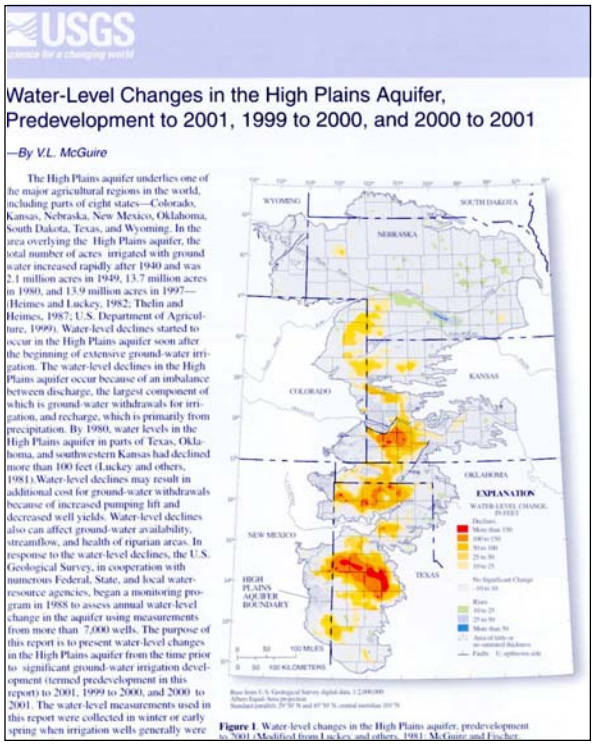

Figure 1. Water-level changes in the High Plains aquifer, predevelopment to 2001 (Modified from Luckey and others, 1981; McGuire and Fischer,

Meet the Faculty

C. William Zanner (continued from page 3)

— Clay mineralogical analyses using x-ray diffractometry for colleagues in SNR, UNL, and at other universities and federal agencies.

Past Research/Extension Programs:

— Controlling non-point source nitrogen pollution on a watershed basis: the Neuse Crop

— Management Project at North Carolina State University.

— Quaternary landscape evolution of southeastern Minnesota.

— Nitrogen nutrition of Minnesota wild rice (*Zizania palustris*).

Other Extension/Outreach Programs:

— Nebraska Range Short Course and the Nebraska Forestry Short Course: Soils and landscapes, soil forming factors. Resource on soils and landscapes for field tours and other extension programs.

Teaching:

— Great Plains Field Pedology, NRES 477/877. Soil genesis, soil taxonomy, soil morphology, and field mapping.

— Wetlands, NRES 468/868. Physical, chemical, and biological processes that occur in wetlands; responsible for the soils of wetland systems and their description and delineation.

— Coach University of Nebraska Intercollegiate Soil Judging Team.

— Mentor two UNL undergrads with UCARE scholarships.

— Co-advisor, UNL Soil & Water Resources Club

Publications:

— Zanner, C. W. and J.C. Bell (editors). In press. *Guide to Minnesota's Wetlands*. Minnesota Board of Water and Soil Resources and University of Minnesota Extension Service.

— Wysocki, D. A,. and C. W. Zanner. 2003. *Landforms*. In Rattan Lal, ed., Encyclopedia of Soil Science, Marcel Dekker, Inc., New York.

— Mason, J. A., and C. W. Zanner. 2003. Pedology, *Soil Classification and Survey of Grassland Soils.* In D. Hillel, C. Rosenzweig, D. Powlson, K. Scow, M. Singer, and D. Sparks, eds., Encyclopedia of Soils in the Environment. Academic Press.

— Doran, J. W., and C. W. Zanner. 2001. *A review of year 2000 research in earth science*: Soils. Geotimes. 46, 7: 37-38.

— Zanner, C. W. 2000. *Protecting Your Wetlands*. North Carolina Farm*A*Syst. North Carolina Cooperative Extension Service, North Carolina State University, Raleigh, NC.

— Zanner, C.W. and E. A. Nater. 2000. *Late-Quaternary landscape evolution in Mower County MN*. In Mossler, J.H, editor. Contributions to the geology of Mower County, Minnesota. Minnesota Geological Survey Report of Investigations No. 50. Minnesota Geological Survey, St. Paul MN.

— Mason, J. A., E. A. Nater, C.W. Zanner, and J.C. Bell. 1999. *A new model of topographic effects on the distribution of loess*. Geomorphology. 28: 223-236.

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bzanner2@unl.edu

George E. Meyer (continued from page 3)

Teaching:

— Biological Systems Engineering 344: *Environmental Factors Affecting Biological Systems* (taught 22 years, last offered in 2000).

— Biological Systems Engineering 460/860: *Instrumentation and Controls*.

— Biological Systems Engineering 244: *Thermodynamics of Living Systems*.

— Biological Systems Engineering 951: *Bioengineering Relationships of Plant Systems* (offered on demand).

— Biological Systems Engineering 998: *Fuzzy Logic for Biological Engineering Applications* (currently in curriculum review process for a permanent 400/800 number bulletin assignment).

Publications:

— Al-Faraj A., G.E. Meyer, and G.L. Horst. 2001. *A Crop Water Stress Index for Tall Fescue (Festuca arundinacea Schreb.) Irrigation Decision-making - A Fuzzy Logic Method*, Computers and Electronics in Agriculture (Elsevier) 32(2):69-84.

— Al-Faraj, G.E. Meyer, and G.L. Horst, 2001. *A Crop Water Stress Index for Tall Fescue (Festuca arundinacea Schreb.) Irrigation Decision-making - A Traditional Method.* Computers and Electronics in Agriculture (Elsevier) 31:107-124.

— Al-Faraj, A., G.E. Meyer, G.R. Schade, and G.L. Horst. 2000. *Dynamic Analysis of Moisture Stress in Tall Fescue (Festuca Arundinacea) Using Canopy Temperature, Irradiation, and Vapor Deficit*. Transactions of the ASAE 43(1):101-109.

— Meyer G.E., T. Mehta, M.F. Kocher, D.A. Mortensen, and A. Samal. 1998. *Textural Imaging and Discriminate Analysis for Distinguishing Weeds for Spot Spraying.* Transactions of the ASAE 41(4): 1189-1197.

— Woebbecke, D.M., G.E. Meyer, K. Von Bargen, and D.A. Mortensen. 1995. *Shape Features for Identifying Young Weeds Using Image Analysis*. Transactions of the ASAE 38(1):271-281.

— Woebbecke, D.M., G.E. Meyer, K. Von Bargen, and D.A. Mortensen. 1995. Color Indices for Weed Identification Under Various Soil Residue and Lighting Conditions. Transactions of the ASAE 338(1): 259-269.

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Tracking Elk to Determine Best Herd Size for Nebraska's Pine Ridge

By Steve Ress

The optimal number of elk in northwestern Nebraska's Pine Ridge area is probably about 600, University of Nebraska-Lincoln research shows.

Scott Hygnstrom, wildlife damage specialist, and Jim Merchant, a geographic information systems specialist, coordinated the School of Natural Resources research project. The team monitored habitat use, movements and population dynamics of Nebraska's elk herds for eight years to better understand how to manage these native but seldom seen animals.

Elk graze in the beauty of a Nebraska Pine Ridge winter landscape (photo: Scott Hyngstrom).

The current elk population in the Pine Ridge includes about 200 animals, equally divided between the Bordeaux area near Chadron and the Hat Creek area near Crawford.

"The optimal number is a somewhat elusive," Hygnstrom said of the Pine Ridge elk. "The habitat in the region could probably sustain up to 2,000 animals. However, the damage they do to crops, such as hay bales and winter wheat, and to fences indicates that only a smaller number would be acceptable to the public."

Researchers tracked 21 female elk with radio transmitters attached to neck collars. Findings provide important insights about the kinds of habitat elk favor for wintering and calving, their forest preferences, use of streamside habitat, and the effects of human activities such as traffic, timber harvesting, farming and ranching on elk distribution.

"We were able to learn a great deal about their population dynamics, movements and habitat selection, in addition to being able to examine them for indications of diseases and general herd health," the Institute of Agriculture and Natural Resources wildlife specialist said.

This was the first study of its kind in Nebraska. Findings indicated the herds are relatively disease-free and generally tend to avoid association with cattle or deer.

Elk are native to Nebraska but had disappeared from the state by the end of the 19th century. They began recolonizing the Pine Ridge region from the Lusk Hills of Wyoming and possibly the Black Hills of South Dakota during the 1960s.

"By the late 1980s, they were thriving to the point that they required management," Hygnstrom said. "As the herd grew, it became a balancing act between the needs and desires of hunters, landowners and the public."

Researchers set out to determine overall ecological factors that would improve management of elk populations. Surveys in association with the research indicated that 55 percent of area landowners favored free-ranging elk in the Pine Ridge, but they also

Elk eat from a hay bale on Pine Ridge property in western Nebraska. Elk that eat livestock feed and damage private property are a concern to local landowners (photo: Scott Hyngstrom).

were concerned about elk damage to crops and property. Ninety-two percent of tourists surveyed supported free-ranging elk and said they would pay to view them.

"Nebraska is unique in that most of the elk here exist on privately owned land, whereas in states such as Colorado and New Mexico, most of the elk herds inhabit public lands. The situation here creates some tension between the elk and private landowners," Hygnstrom said. "It's not that we have too many elk but that the elk spend too much time in the wrong areas."

Researchers are developing research-based management recommendations for the Nebraska Game and Parks Commission, including how the two herds can be dispersed from private to publicly owned land. Hunting is one way to trim the population, but Nebraska currently issues about 50 elk permits annually, and about half those hunters bag an elk.

Hygnstrom wants to continue this work by resurveying the herds, and studying mating patterns and possible genetic effects of inbreeding in the small herds.

The Nebraska Game and Parks Commission, Rocky Mountain Elk Foundation, U.S. Forest Service and Nebraska Bowhunter's Association funded this research, with cooperation from Pine Ridge landowners.

UNL Water Law, Policy and Science Conference is Mar. 4-5 (continued from page 1)

roads of many of the most vexing and contentious legal battles over scarce water resources.

"We hope to foster continuing dialogue and research among legal experts, scientists, engineers, economists and other water-related disciplines in an effort to understand ecological and human needs and reach sustainable management solutions," said visiting associate professor of law Sandi Zellmer.

Keynote speakers are Sandra Postel, director, Global Water Policy Project, Amherst, MA; Robert Glennon, Morris K. Udall Professor of Law and Public Policy at the University of Arizona College of Law; and Joseph L. Sax, James H. House and Hiram H. Hurd Professor of Environmental Regulation, University of California-Berkeley.

Other speakers include Roger Patterson, director of the Nebraska Department of Natural Resources; Betsy Reike, U.S. Bureau of Reclamation area manager, Carson City, NV; J.B. Ruhl, Matthews and Hawkins Professor of Property, Florida State University College of Law; Jay Stein, chair, committee on water resources, American Bar Association. Section on Energy and Natural Resources (2002-2003), Santa Fe, NM; and Gerald E. Galloway, former U.S. Section Secretary, International Joint Commission, NRC panelist, Missouri River Report.

"There are many other well-known experts speaking, including many UNL scientists in environmental issues," Zellmer said. "These include Kyle Hoagland, director, and J. Michael Jess, associate director, UNL Water Center; Ed Peters, UNL School of Natural Resources; and J. David Aiken, UNL College of Law."

Broad conference topics cover strategies for reaching consensus in multi-jurisdictional contexts; water marketing and its implications for human priorities and fish and wildlife; water as property; constitutional "takings" claims; and using best available science to resolve conflicts between water uses and the needs of endangered species.

Conference outcomes will be published in a symposium issue of the *Nebraska Law Review*, Zellmer said.

The cosponsoring WRRI leverages external funding to help provide for a broad spectrum of surface and groundwater research. It involves faculty and staff from UNL's School of Natural Resources, Water Center, Departments of Geosciences, Biological Systems Engineering, Civil Engineering, Agronomy & Horticulture, Chemistry, and the College of Law, cooperating on research and programming relevant to Nebraska and the great plains.

The conference is sponsored by the College of Law, Institute of Agriculture and Natural Resources, School of Natural Resources, Water Center, University of Nebraska-Lincoln, Nebraska Water Conference Council, Rocky Mountain Mineral Law Foundation and Nebraska Bar Association - Natural Resources Section.

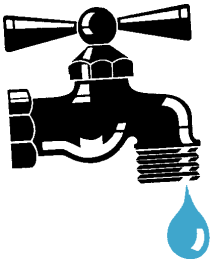
For a registration brochure, contact the UNL Water Center at (402)472-3305 or e-mail sress1@unl.edu. Additional information and an online registration option are available at snr.unl.edu/waterconference2004

Water Levels Continue Decline in High Plains Aquifer (continued from page 6)

The greatest water level changes are in southwest Kansas and the southwestern part of the Texas panhandle, where up to more than 50 percent of the predevelopment saturated thickness of the aquifer has been dewatered.

Water level measurements used in the annual report are collected in the winter or early spring when irrigation wells generally are not pumping.

The report is titled *Water-Level Changes in the High Plains Aquifer, Predevelopment to 2001, 1999 to 2000, and 2000 to 2001*, by V.L. McGuire. For a copy of the report contact USGS, Federal Bldg., Room 406, 100 Centennial Mall North, Lincoln, NE 68508, phone (402)437-5082 or go to http://ne.water.usgs.gov.



Water News Briefs

2004 SNR Calendar and New Publications

Full-color 2004 UNL School of Natural Resources wall calendars are available free from the UNL Water Center, while supplies last, by emailing sress1@unl.edu or phoning (402)472-3305. A limited number of 2003 SNR calendars, featuring historic black-and-white photography also remain available. Readers desiring a copy of the new SNR informational brochure, 2004 Water Center pocket resources directory or the summer special edition of the SNR's Resource Links newsletter can obtain them at the above points of contact, as well,

It's China By A Mile!!

It isn't even close. China has more dams than any other country in the world…nearly half the world's big dams and more than the second through tenth place countries in total dam count, combined. The "Big dam top 10" are:

1.	China	22,000
2.	United States	6,575
3.	India	4,291
4.	Japan	2,675
5.	Spain	1,196
6.	Canada	793
7.	South Korea	765
8.	Turkey	625
9.	Brazil	594
10.	France	569

(From U.S. Water News, November 2003).

Upcoming Events

Rediscovering Missouri River Connections, annual basinwide conference dedicated to the environment of the Missouri River, May 23-26, Holiday Inn Select, Columbia, MO. For information, go to http://infolink.cr.usgs.gov/events/04.htm or phone Brian Canaday at (573)522-4115 (ext. 3371).

National Institute for Water Resources (NIWR) annual conference, March 14-16, Washington Plaza Hotel, Washington, D.C. For information, email Jan Schoonmaker at jans@vsadc.com

We're Updating!!

We are updating our mailing list. If you have a change of address, title and/or name, or would like to have your name added to or removed from the *Water Current* mailing list, please let us know. Also, if you know of anyone who might be interested in receiving our publications, please give us their names and we will be glad to add them to our mailing list.

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Lower Levels at Lake McConaughy Reveal Shoreline Erosion

By Steve Ress, UNL Water Center and Charles Flowerday, UNL School of Natural Resources

Near-record low water levels at Lake McConaughy reveal the unseen effects of more than 60 years of shoreline erosion and problems associated with building large reservoirs, a University of Nebraska-Lincoln geologist said.

The lake north of Ogallala on the North Platte River is Nebraska's largest reservoir. It was filled in 1952 after Kingsley Dam's completion in 1941. Lake McConaughy was built for irrigation but it's also popular for recreation. Some of the side effects of residential and recreational development along the lake's shoreline have been hard to predict, however.

"As with anything we manipulate in the landscape, there's always a risk factor. And certain levels of risk are hard to account for," said Matt Joeckel, a UNL School of Natural Resources geologist studying erosion at the lake.

He and UNL geologist Bob Diffendal took advantage of the low water to learn about reservoir erosion by examining damage previously submerged for up to a half century.

The extent of erosion became more visible when lake levels fell nearly 60 feet after several years of drought. The shrinking lake revealed shoreline erosion stretching as far as 700 feet inland from the bluffs that lined the North Platte River before the lake covered them. In places, the exposed lake floor has undergone extensive wind erosion. At one site, 10- to 12-foot-high dunes have formed against the base of a cliff.

Waves up to several feet high, whipped by prevailing northwesterly winds, are a significant erosion force on the lake's southeastern shore, but much of the remodeling of the lake's shore probably resulted from the original filling of the lake, Joeckel said.

The actual rate of shoreline erosion is hard to calculate, he said, but it has probably averaged one to two feet per year on protruding headlands, which are bluffs or ridges extending from the lake's shore, where wave energy is concentrated, and has been negligible on the slopes of some bays where large blocks of eroded bedrock already existed before construction.

"The entire picture of shoreline erosion is complicated because it includes the effects produced as the lake filled, as well as ongoing erosion by waves from the lake's post-1952 shoreline," Joeckel said.

In general, shoreline erosion often is gradual but eventually can threaten lakefront properties. However, Joeckel emphasized, "we can rest assured that no one's home or cabin is going to pitch into Lake McConaughy anytime soon."

Erosion's effects include formation of cliffs at the ends of protruding headlands and the subsequent toppling of large blocks of soil and soft rock. These blocks can be as much as 20 to 30 feet wide and are some of the most obvious evidence of erosion, but no homes are threatened, he said.

"The lake wasn't built as a recreational property and some problems have developed, but owning coastal property anywhere is a game of chance and people need to know that. Considering that, no one is really at fault here," Joeckel said.

The original design and current management plan for the lake provides for erosion, but in a few cases, specific agreements have had to be made with landowners. Central Nebraska Public Power and Irrigation District, which manages the lake, "seems to have a proactive strategy in

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A seawall helps protect residential property from erosion damage on the southeast shore of Lake McConaughy north of Ogallala, Neb. Continued drought has shrunk the state's largest reservoir and revealed previously unseen effects of more than 60 years of shoreline erosion. Some property owners have built seawalls or graded cliff faces to slow erosion. University of Nebraska-Lincoln geologists are studying the erosion to learn more about its impacts in reservoirs. (NU Institute of Agriculture and Natural Resources photo.)

Lower Levels at Lake McConaughy Reveal Shoreline Erosion (continued from page 11)

dealing with erosion issues," Joeckel said.

While seaside erosion is a well studied and widely known, it's impacts on large, manmade reservoirs aren't well documented, he said. UNL researchers hope their studies provide more information about this and other effects associated with the lake.

"It is a case study in how, when you combine the irrigation management aims, the recreational goals and the total natural and engineered systems, we're not always capable of balancing those all the time," he said. "It's almost like a teeter-totter to hold it in equilibrium."

Some of the lake's property owners have built expensive steel or concrete seawalls, while others have graded the cliff faces and debris into more gentle slopes to slow further erosion.

But stopping or slowing shoreline erosion on anything but a small scale probably is more expensive than most landowners can afford, Joeckel said. Local geology, prevailing winds and the pre-lake shape of hills helped predispose the southeastern shoreline to erosion problems.

While different in nature, erosion damage to lakefront property is roughly as inevitable and hard to control as damage resulting from building in a flood plain, Joeckel said.

"We need more comprehensive long-term planning and cost-benefit analysis if we're going to put high demands on the physical and natural environments. With some of these problems, you can consult an engineer, but don't expect to solve them completely in the long term," he said.

Erosional features visible at the lake include sandy pocket beaches in arcs about 150 to 450 feet wide; and beach ridges as wide as 30 to 60 feet. Others include knobs or pinnacles; caves; low platforms of bedrock leading back to the cliffs; and fracturing of bedrock as it breaks up on its way to becoming sand and gravel. A delta also has grown about two and a half miles into the western end of the lake.

The research is ongoing, but the team has shared its findings at scientific meetings and with lake management agencies.

Sand dunes form along the base of a cliff on the southeast shore of Lake McConaughy where near-record low water levels are revealing previously unseen effects of more than 60 years of shoreline erosion. Geologists in the University of Nebraska-Lincoln's School of Natural Resources are taking advantage of low lake levels to study the exposed damage with an eye toward better understanding reservoir erosion. (NU Institute of Agriculture and Natural Resources photo.)

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